

Emergency Lighting System Transverse Fuselage Separation

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Requirements

- FAR 25.812(a) states the emergency lighting system must include:
 - (a)(1) interior exit marking and locating signs, general interior cabin illumination, and floor escape path markings
 - (a)(2) exterior emergency lighting

Requirements

- FAR 25.812(l) - Designed such that a Transverse Vertical Separation (TVS) of the fuselage during a crash landing will:
 - (l)(1) not render more than 25% of the lights inoperative
 - (l)(2) electrically illuminated exit sign remain operated except those directly damaged
 - (l)(3) one exterior light on each side of the airplane remain operative except those directly damaged

Guidance for FAR 25.812(l)

- TVS effects on system wiring needs to consider conductor to fuselage direct shorts as well as conductor to conductor direct shorts. Multiple shorts can happen with TVS and need to be considered
- FAA Memorandum dated 2/26/86 specified this guidance during the implementation of escape path marking system certification

Guidance for FAR 25.812(l)

- AC 25.812-1A included the guidance provided in the FAA Memo
- This guidance is applicable for both interior general emergency lighting system as well as escape path marking lighting system
- 25.812(l)(1) for the 25% criteria can shown with both the general lighting and escape path lighting combined or each considered separately

Guidance for FAR 25.812(l)

- The transverse fuselage separation rule is for the emergency lighting system design. It does not mean the fuselage has separated such that it impacts emergency evacuation along the escape path/aisle.

Executive Interiors

- Airplane may be delivered “Green” - No interior installed/partial emergency lighting system
- Consideration of existing airplane TC configuration when adding either emergency general illumination, exit signs, or escape path markings
- Added wiring, lights, controls must be compatible with original system design

Thermal/Acoustic Insulation

Approach to Fire Safety

DER Recurrent Seminar


CHART C1 Breakout

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Background

- Thermal/Acoustic Insulation is Typically Installed in Hidden Areas
- Typically Throughout the Entire Fuselage
- Existing Flammability Standard Not Specific to Material Type or Installation (12 Sec. Bunsen Burner)

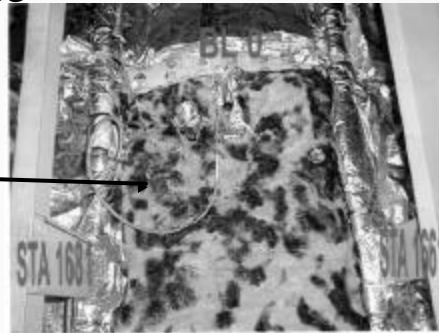
Background

- Service History
 - Incidents
 - Accidents
- Research Data 
 - Experimentation Test Standards

Background- Service History

- Several Incidents Suggest Current Standards Adequate

Typical Metalized MPET
Burn Pattern



Background- Research Data

- Two Main Areas of Research
 - In-Flight: Flame Propagation
 - Post-Crash: Flame Penetration (Fuselage Burnthrough)

Research Data-Flame Propagation

- Extensive Research to Evaluate Current Standards and Develop New Standards
- Based on Full/Medium/Small Scale Experiments
- Coordinated with International Aircraft Materials Fire Test Working Group
 - Website: <http://www.fire.tc.faa.gov>

Regulatory Approach

- #1 Priority: Address Safety Issues
- Consider Practicalities
- Take Advantage of Benefits that are Available

Material Performance Issues

- Ignition Source
- Heat Release
- Installation Geometry

Safety Issues

- Resistance to Ignition
- Propagation, if Ignited

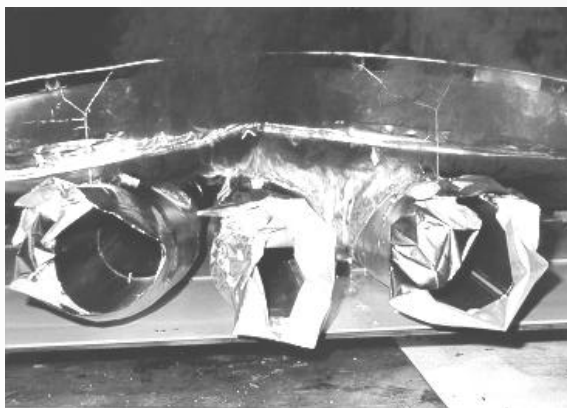
Safety Issues: Resistance to Ignition

- Electrical Arcing
- Other Small Ignition



Safety Issues: Propagation

Medium Scale
Propagation Test



Identifying Acceptable Level of Safety

- Assumption that Materials Meeting Current Requirements will not Propagate a Small Ignition
- Tests Show that, with One Exception, All Commonly Used Materials Meet This Objective,
 - ⇒ Metalized Polyethyleneteraphthalate (MPET) May Propagate a Small Ignition

Regulatory Approach

- Evolved into Two Types of Actions
 - 1 Airworthiness Directive-Existing Fleet
 - 2 Rule Change-Future Airplanes. NPRM Issued 9/8/00. Published in Federal Register on 9/20/00.

Airworthiness Directive

- AD 2000-11-01 and -02, Certain MD-80/90/DC-10/MD-11
- Corrects an *Unsafe* Condition
- Issues of Economics Considered, but unsafe condition must be corrected
i.e., When, not If
- 5 Year Compliance Time/Complex Installation

Airworthiness Directive

- Replace Insulation with Materials that Meet New Flame Spread Test Method
 - Specified in the ADs
- DERs May be Asked to Support STC Projects for Replacement of MPET Insulation Blankets

Maintenance Complexities

- Insulation is one of the First Components Installed During Production
- Critical Systems Permeate the Installation
- Accessibility is Severely Restricted in Some Areas
- Not Simple Rectangular Shapes

Maintenance Complexities

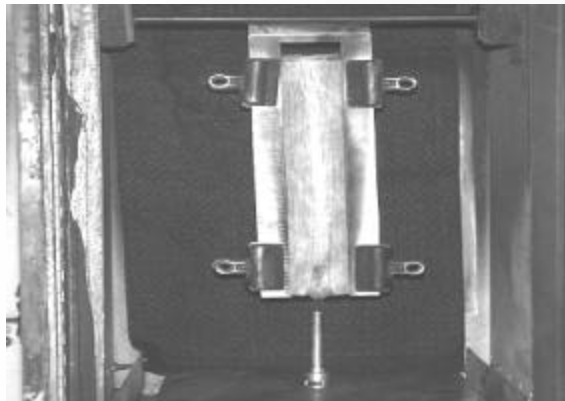


Rule Change

- Upgrades the Level of Safety
- Issues of Economics Will Play Major Role in Specifics of Proposal
- NPRM Addresses FAR 25, 91, 121, 125, and 135
 - Adds FAR 25.856 and Appendix F, Part VI
 - Available @ <http://www.fire.tc.faa.gov>

Existing Requirements

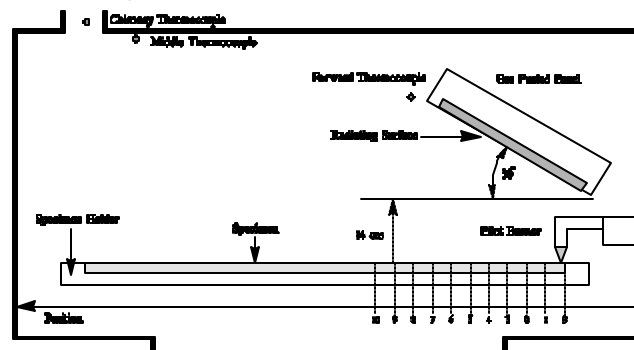
- Bunsen Burner Flammability Test



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- Flame Propagation (In flight Fire)
- Flame Penetration (Post Crash Fire)

- Piloted Radiant Panel Exposure of Assembly



New Tests- Flame Penetration



Proposed Amendments

- Would be Applicable to Both Type Design and Operating Rules (Parts 91, 121, 125, 135)
- Would Require Both Enhanced Flame Propagation and Improved Flame Penetration

Effect Of Proposal

- Most Currently Used Materials Do Not Comply with Either Provision
 - However, Materials that Comply are Currently Available
- Most Airplanes Will Require Design Changes to Comply with Burnthrough

Cost/Benefit Implications- Retrofit

- A Total Fleet Retrofit Cost Estimated at Several Billion \$
- Retrofit Benefits Do Not Substantially Increase Once MPET is Removed
 - Benefits for Materials Other Than MPET Cannot Be Quantified

Executive/Private Use Airplanes Exemptions

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High Impact Regulations for Executive Airplanes i.e.,

- Why Exemptions may be Requested for Private Use Airplane Interiors
 - Flammability
 - Dynamic Testing of Seats
 - Interior Arrangement
 - Evacuation

Relevant Requirements

- Flammability
 - Heat Release/Smoke Density Testing
- Seats - Number of Tests
- Interior Arrangement
 - Many Compartments/Amenities
 - Direct View
- Evacuation
 - Exit Access/Arrangement
 - Emergency Lighting

Some Requirements May Need to be Made More Stringent

- Fire Detectors
 - Remote, Unoccupied Areas
 - “Stowage” Compartments
- Fire Extinguishers
 - Many New Potential Fire Sources
 - Large Airplane/Low Pax Capacity

Complex Interior Arrangement



Exemption

- Must Provide an Acceptable Level of Safety
- Must be in the Public Interest
- Allows Consideration of Factors Outside of Type Design
- Requires Regulatory Process
- Multiple Findings Required

Exemptions Granted

- Boeing Exemption 6820 and 6820A
- Bombardier Exemption 7259
- Some Exemption are Granted to Individual Modifiers/Owners/Operators

Boeing Exemptions 6820 and 6820A

- Interior Doors - FAR 25.813(e)
- Low Heat Release/Smoke Emissions Materials - FAR 25.853(d)
- Flight Attendant Direct View - FAR 25.785(h)(2)
- Distance Between Exits - FAR 25.807(d)(7)

Boeing Exemption Limitations

- Primary Limitations
 - Not Operated for Hire
 - Not Offered for Common Carriage
 - Passengers Briefed on Non-Compliance
- STC Limitation Section and AFMS Must Include Exemption Information
- Specific Requirements/Limitations Associated with Each Grant

Interior Doors

- Allows Doors Between Passenger Compartments
- Frangible
- Double Latched Open
- Cockpit Indication
 - When Door is Not Open for TT&L
- Pocket Door if Across Escape Path

Interior Materials

- Evacuation Must Be Demonstrated within 45 seconds
 - Deactivation of Exits
 - Location of Flight Attendant
- Smoke Detectors Required in All Isolated Compartments
 - Bedrooms, Galleys, Lavatories, Stowage Compartments, Crew Rest Areas

Direct View

- Majority of Flight Attendant Seats Must Face the Cabin
- No Specific Percentage of Passenger Viewing Required

Distance Between Exits

- Passenger Seat Locations Restricted to Minimize Distance to an Exit
 - Addresses One or Both Overwing Exits Deactivated
- Capacity in Each Remaining Zone is Limited
 - 34 Passengers Seats within 30 Feet of either Pair of Type I Exits

Bombardier Exemption 7259

- Interior Doors - FAR 25.813(e)
- Same Primary Limitations as the Boeing Exemption
 - Not Operated for Hire
 - Not Offered for Common Carriage
 - Passengers Briefed on Non-Compliance
 - STC Limitation Section and AFMS Must Include Exemption Information

Interior Doors

- Allows Doors Between Passenger Compartments
- Frangible
- Double Latched Open
- Cockpit Indication
- Pocket Door if across Escape Path
- Specific Requirements for Doors and Passengers at aft end of the airplane